



Fulton Beer Company



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Company Background

Fulton Beer started out as a local homebrew operation in a south Minneapolis garage in 2006, then was formally founded in 2009. In less than a year, Fulton beer was in over 100 bars in the Twin Cities. In 2011, Fulton built Minneapolis' first taproom/brewery at their 20 bbl production facility. Within two years, Fulton had maxed their taproom's production capacity, so they purchased a building in NE Minneapolis and retrofitted it into an 80 bbl production facility. Currently, Fulton has reached production capacity of 33,000 bbl/year brewing five beers year round with another 26 seasonally. Their distribution spans throughout the Midwest and plans to reach the east coast within several years.



“Working with Fulton Beer Company was a great and educational experience. It was great learning about the brewing process and how to make it more sustainable. This experience has greatly furthered my skills as an engineering student, and my ability to approach a problem critically to come up with creative solutions. I am grateful to MnTAP for giving me the opportunity to apply my engineering skills in the field and I'm confident that the experience I gained will be an asset throughout my career.” ~ KW-J

Project Background

Fulton uses water supplied by the city of Minneapolis. This water is dechlorinated to prevent degradation of their stainless-steel brewing equipment and then used in for beer production, floor, tank, and packaging rinses, and lubrication for conveyor lines. Fulton is aware of their high water usage and has manufactured equipment to help reduce their consumption. This includes several process lines that recycle used cooling water into their hot liquor tank. In addition, Fulton has made efforts to minimize and recycle their rinse water. Fulton has also built a basic pretreatment system to remove solids and neutralize the pH of their high strength effluent. Although they have implemented several means to reduce their recourse consumption, there was still much room for improvement.

Incentives To Change

The brewing industry is a highly water intensive process. A craft brewer can use anywhere between four and nine gallons of water to produce a single gallon of packaged beer. Much of this water is heated water, making the process even more energy intensive. Fulton will likely use over 5,000,000 gallons this year. In addition, the brewing industry produces a lot of high strength wastewater. This water contains high levels of organics and solids, such as yeast, spent grain, and alcohol which contribute to the total suspended solids (TSS) and chemical oxygen demand (COD) of the effluent. This water is expensive to treat. As such, the Metropolitan

Council, the regional wastewater treatment organization has issued surcharges based on effluent strength and volume to breweries to help pay for the water treatment. Fulton wanted to investigate ways to reduce their effluent strength and water usage, thus reducing costs and making their company more sustainable as they continue to grow.

“During Karl’s internship, he identified areas of improvement on water consumption, waste water surcharge reduction, and boiler efficiency. He explored many engineering solutions for each problem and we are confident he found the most economical and diligent process for us. We are grateful for his effort and will use his knowledge towards operating as efficiently as we can.”

~ Paul McDonald, Plant Manager, Fulton Brewing

SOLUTIONS

Water Reuse for Bottling Line Vacuum Pump

To increase beer shelf life, a liquid ring vacuum pump is used on the bottling line to evacuate air and CO₂ from the bottles before filling. The water in the pump heats up during operation, which reduces the vacuum. Warm water is discharged from the pump and replaced with fresh cooler city water at a rate of 5.25 gal/min. By adding an appropriately sized heat exchanger with a glycol loop, Fulton could

Solutions

cool and reuse the vacuum pump water. This would save up to 220,000 gallons per year. If Fulton does not install a recirculation loop on their vacuum pump, they should install a reclamation vessel next to the bottling line. This vessel would capture all the pump discharge and store it for use in floor rinses, fermenter clean in place (CIP) operations and additional spray rinses on the bottling line.

Canning Line Rinse Water Reduction

Fulton was using clean city water for both internal and external rinses on their canning line. Rinses are performed to remove any particulates on the inside of cans, and beer and foam on the outside. Because the cans are largely clean, the internal rinse water is suitable for external rinsing. The supply and demand of these two rinses were balanced by replacing low efficiency, high volume sprayers for the external rinse with high efficiency nozzles. The flow rate can continue to be fine-tuned with a needle valve to minimize water consumption. Reclaiming and reusing this water will save Fulton over 150,000 gallons per year in city water usage.

Replace Broken Valve on Kegging Line

All the rinsing bays in the kegging line have makeup water lines to compensate for water loss during operation. The makeup water is controlled with float valves. A broken valve on a caustic bay caused unnecessary hot water to be added, which overflowed straight to the drain. Fixing this valve will save Fulton 74,000 gallons per year of hot water and 540 therms for heating.

Evaporate Yeast & Trub Water-mix with Spent Grain

During fermentation, dead yeast and hops (cold trub) collect at the conical bottom of the fermentation vessel. When the beer is transferred to another fermenter or bright tank, all the yeast and hops at the bottom are drained out. These dumps contain the highest concentration of TSS and COD

and are also the largest sources of TSS and COD in the effluent. A usual dump is between 300 and 500 gallons and when combined with the hot trub from the brewhouse, it can be responsible for up 2/3 of the total effluent strength charge. Instead, it can be side-streamed to an evaporator, reducing its moisture content, mixed with spent grain, and sold as animal feed. This will drastically reduce Fulton's wastewater strength charge and generate additional revenue.



Install Flatjet Nozzles in Kettle

After beer is transferred to the fermenters, there is a large pile of hops (hot trub) left in the kettle. This material is high in organics and solids. To remove this, brewers use large amounts of water to fluidize the trub and spray it towards the drain. The trub is mixed with grain at the end of the night and the water is raked out. Fulton can install high efficiency flatjet nozzles to slide the trub to the drain. Installing these nozzles will reduce water consumption up to 41,000 gallons per year, and help minimize the volume of solids and organics entering the sewer, thus saving Fulton money on their strength charge.

Add Insulation to Boilers

Fulton has two low pressure steam boilers used for production. The boilers have uninsulated head plates that are typically at 240° F. These plates radiate enough heat to elevate the boiler room temperature up to 130° F. Not only does this cost money, but it also makes working in that room unbearable.

Recommendation	Annual Reduction	Annual Savings	Status
Bottling line vacuum pump water reuse	220,000 gallons	\$2,200	Recommended
Canning line rinse water reduction	150,000 gallons	\$1,500	Implemented
Kegging line broken valve replacement	540 therms	\$1,100	Recommended
Evaporator for fermentation waste	115,000 lbs solids	\$9,200	Recommended
Install flatjet nozzles in the kettle	41,000 gallons	\$400	Testing
Insulation for boiler head plates	1,600 therms	\$1,000	Recommended

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